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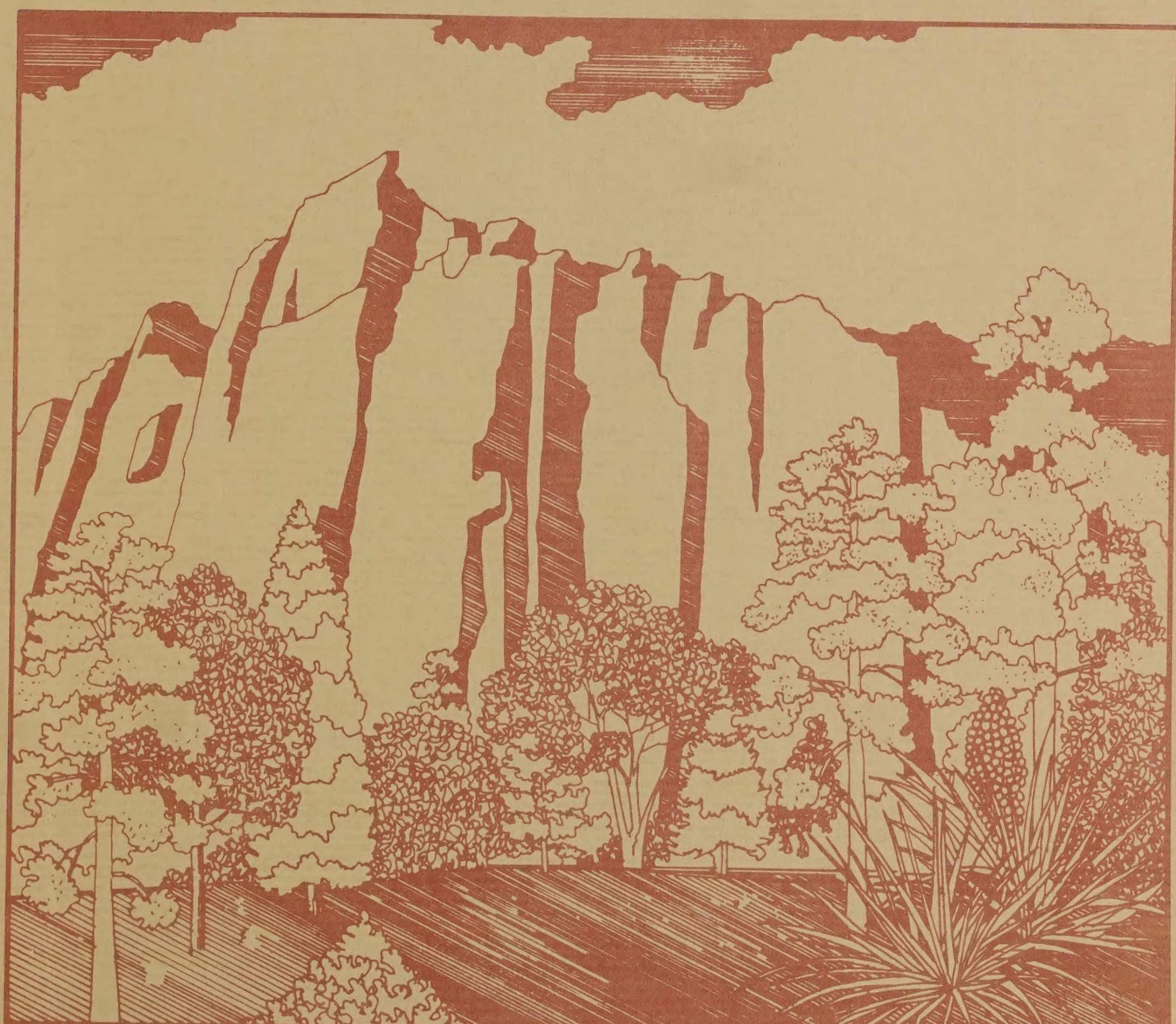
Forest Pest Management Report

R-3 90-2

BIOLOGICAL EVALUATION OF PEST CONDITIONS AND
POTENTIAL HAZARD TREES IN THREE CAMPGROUNDS
ON THE CAMP VERDE RANGER DISTRICT,
PRESCOTT NATIONAL FOREST, ARIZONA

MARCH 1990



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ACKNOWLEDGEMENTS

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INTRODUCTION

In 1989, Forest Pest Management in Region 3 initiated an insect and disease incidence survey of recreation sites. These surveys were conducted to evaluate the overall "health" of proposed and existing campground (CG) areas on the National Forests. The following campgrounds were surveyed at the request of Karl McCormick, Forestry Technician, Camp Verde RD:

Mingus Mountain CG
Potato Patch CG
Powell Springs CG

The information supplied in this report offers pest management considerations for vegetation management plans.

OBJECTIVES

The objectives of this survey were to: (1) Evaluate and document the incidence of insect and disease activity and damages in proposed and existing recreation sites, and (2) detect and document hazardous trees in developed sites.

METHODS

The procedures followed are described in the "Inventory of Insects, Diseases, and Hazard Tree Incidence Work Plan for Developed and Proposed Recreation Sites of National Forest System Lands, Southwest Region" (Rogers, 1989). The study within each recreation area was two part, a hazard tree analysis and an insect and disease survey, with the exception of Powell Springs CG where only the hazard evaluation was done. Procedures for the hazard tree analysis were patterned after those developed by Johnson (1981). A hazard tree is defined as any tree with both a mechanical defect that could cause the tree to fail and a potential target. Only trees showing structural defects and located in areas of intensive public use, e.g. within and adjacent to camping sites, toilets, and parking pads, were evaluated. The individual tree data included: Species, diameter inside bark (DIB), location, defect, and hazard rating, which was recorded on a Tree Hazard Evaluation Form (Appendix A).

The hazard rating system used is a two-part failure/risk rating system, each part using a descriptive rating scale of High (H), Medium (M), and Low (L) to estimate probability. The first part of the rating system is an estimate of the probability of mechanical failure of the tree, or major portions of the tree,

within the next five years. This estimate is based on a number of factors including: Presence of decay, condition and location of roots and crowns, and amount of lean. The second part of the rating is an estimate of the probability of injury to people or damage to property if the tree does fail. Only trees located in areas more likely to be occupied by people or property (risk rating = high or medium) were recorded on the evaluation forms.

The insect and disease survey was performed either as a plot survey utilizing methods described for the Region 3 Stage II Stand Exam Survey (Silvicultural Examination and Prescription Handbook, FSH 2409.26d) or a 100 percent survey of all trees, depending upon campground size. For Mingus Mountain CG points were established. Data was recorded on the Forest/Stand Tree Record Sheet (R-3 FS 2400-106), run through the Region 2/3 Stage II Data Entry/Runstream Generation program and submitted to the Fort Collins Computer Center for analysis. In Potato Patch CG, the insect and disease survey was conducted concurrently with the hazard tree analysis. Those trees displaying insect or disease damage were recorded on the Forest/Stand Tree Record Sheet. For each tree, the location relative to some permanent feature was recorded along with the following data: Species, diameter at breast height (DBH), height, tree history, a damage code, and a code for dwarf mistletoe rating (DMR) (Hawksworth, 1977).

An additional survey, evaluating effects of past dwarf mistletoe treatments, was conducted at Mingus Mountain CG. Forest Pest Management (FPM) funds were utilized there to conduct a mistletoe suppression project in 1973. A survey was conducted by FPM personnel in 1972 and reported in an evaluation in 1973 (M.J. Weiss, 1973). During the survey, infected trees were tagged and information regarding dwarf mistletoe ratings, tree diameters, and more were recorded. Later, infected trees were pruned or felled, depending on the severity of infection. To evaluate the effectiveness of the 1973 treatment the following data were collected: Species, DBH, and DMR; and compared to the data collected previously.

RESULTS AND DISCUSSION

Elevations at the sites vary from 5,400 feet at Powell Springs CG to 7,600 feet at Mingus Mountain CG. Ponderosa pine is the predominant tree species at both Mingus Mountain and Potato Patch CGs. Other species present at those sites include alligator juniper, Gambel oak, and New Mexico locust (Mingus Mountain CG only). The three species present at Powell Springs CG include ponderosa pine, Emory oak, and alligator juniper.

A total of 33 hazard trees were recorded in the three recreation sites surveyed. The number of trees per site in each rating class or category are listed in Table I. Detailed information on defective trees and their location are on the Tree Hazard Evaluation Forms for each site in Appendix A.

Table I. Summary of hazard trees by rating class for each recreation site surveyed on the Camp Verde Ranger District.

Campground	H/H[a]	M/H	L/H	H/M	M/M	L/M	Total
	Number of Trees with Rating of:						
Mingus Mountain	3	5	6	1	6	1	22
Potato Patch	0	0	1	0	2	1	4
Powell Springs	3	3	0	1	0	0	7
Total	6	8	7	2	8	2	33

[a] Failure/Risk Rating: H = High; M = Medium; L = Low.

The greatest number of hazard trees (22) was found at Mingus Mountain CG. Half of these were recently killed by bark beetles, primarily western pine beetle, and pine engraver beetle. The presence of bark beetle attacks may indicate that the tree has been weakened by other agents including root diseases, and dwarf mistletoe. Snags are the most dangerous type of tree hazard (Johnson, 1981), particularly over time as decay organisms cause more and more structural weakening. At present, the trees just killed by the beetles display no signs of internal defect. As a result, they were assigned a moderate or low risk of failure. Some are located in the vicinity of permanent structures and high use areas. Four pines had dead or broken tops, which may indicate that the trees have some internal rot, however, none was reported in the lower bole. None of the pines were assigned a high risk of failure. High failure/high risk ratings were noted for three Gambel oak trees. Two of those displayed crown defects, primarily large dead branches. The third was a dead tree. In general, limb, butt, and bole failures are more common in hardwoods, such as oaks, than softwoods (Johnson, 1981).

Four hazard trees were recorded at Potato Patch CG. Three were ponderosa pine, one was a Gambel oak. Among the pines, one was recently attacked by western pine beetle, one had a dead top, and the last had a large bole wound. None were assigned to the high failure/high risk category. The Gambel oak had a dead top. It was located in a moderate use area.

Seven hazard trees were recorded at Powell Springs CG, all Emory oak. The defects noted included both weak forks and dead tops. Three of the oaks were recorded in the high failure/high risk category. Six of the seven were located in the vicinity of permanent structures, high use areas, etc.

The hazard ratings provided are not recommendations for action. They are a professional estimate of the probability of tree failure and should be used by the land manager during the decision-making process for management plans in recreation areas.

At Mingus Mountain CG the main insect and disease activity was from western pine beetle, pine engraver beetle, and southwestern dwarf mistletoe on ponderosa pine. Eleven trees were attacked and killed by bark beetles. Dwarf mistletoe is also prevalent on the site. Results of the stand exam survey are shown in Table II.

Table II. Information from Stage II stand examinations of recreation sites at Mingus Mountain CG.

	Understory	Overstory	Total
QSD[a]	15.3	11.0	11.6
BA[b]	34	122	156
# stems[c]	27	186	212
DMR[d]	.1	.6	.5
# stems killed by bark beetles[e]			5.1

[a]QSD = quadratic stand diameter

[b]BA = basal area/acre

[c]# stems = # stems/acre

[d]DMR = Hawkworth's (1977) dwarf mistletoe rating.

[e]# stems killed by bark beetles = number killed per acre

A total of 16 points were established. The amount of bark beetle mortality is not surprising given the high stocking levels at the site (BA = 156, but varying from 50 to 250 at different points), moderate dwarf mistletoe levels, and the low precipitation in 1989. The amount of dwarf mistletoe at the site is greater in some areas than indicated by the stand exam survey. This will be discussed later. Significant mortality caused by bark beetles has been noted during forest pest management aerial detection surveys in the past, particularly between 1975 and 1983. Mortality will likely continue, especially during dry years, until stocking and dwarf mistletoe levels are reduced.

The results of the dwarf mistletoe survey at Mingus Mountain CG showed that the average rating of the infected trees has increased since 1972, from 2.3 to 3.9. This number is higher than that reported by the stand exam survey since it represents an average only of the infected trees in the campground in two specific areas (see map, Appendix B). The number reported from the stand exam is based on the plot survey and represents the average rating for the area as a whole, including the uninfected trees. The substantial increase in rating of the infected trees at Mingus Mountain CG contrasted with results from surveys at three other campgrounds on the Prescott NF, located in Horsethief Basin (Fairweather, 1990). We believe that the combination of higher initial infection levels and the harsher site at Mingus Mountain CG in comparison to the conditions at the other areas contributed to this result. In addition, there was no followup treatment at Mingus Mountain CG as there was at the other sites. Although the mistletoe was not eliminated by the pruning treatment, individual tree vigor was enhanced by removing large witches brooms. The longevity of many of the pruned trees was probably improved. However, these trees will continue to decline over time as the mistletoe infection continues

to intensify. Eventually, these trees will die. In the previous treatment, one area located within the area labeled DM 2 (refer to map) was not treated at all. At the time, all the trees in that area were severely infected and it was felt that removing them would open up the site too drastically. Many of the trees located there are now dying or have died. This will continue into the future.

At Potato Patch CG both bark beetle activity and dwarf mistletoe was detected. Four trees were attacked by western pine beetle, two current attacks, and two unsuccessful attacks. The trees that were unsuccessfully attacked this year may be attacked again within the next few years. However, the risk of further mortality should be lower at this site than Mingus Mountain CG. Stocking levels, though not measured, did not appear excessive. The level of dwarf mistletoe is very light. It was noted on only two trees. The individual tree ratings for them were 1 and 4.

BIOLOGY OF PESTS

Southwestern Dwarf Mistletoe - *Arceuthobium vaginatum* subsp. *cryptopodum*:

Southwestern dwarf mistletoe (SWDM) is the most damaging disease of southwestern ponderosa pine, *Pinus ponderosa* var. *scopulorum* Engelm (Hawksworth, 1961). Dwarf mistletoes are parasitic, seed-bearing plants that depend on their hosts almost completely for their water and nutrients. The disease spreads by explosively released seeds which are expelled to distances ranging from 10 to 40 feet. Seeds of SWDM are released in late July and early August. Infection follows a few months after dispersal, most taking place through the bark on needle-bearing portions of twigs. Dwarf mistletoes first produce an endophytic system, a specialized root-like structure that is in contact with the phloem and xylem of host trees, from which the parasite obtains most of its nutrients and water. The aerial shoots appear between 2 to 5 years after infection; this period of infection before shoots are visible is known as the latent period.

The disease causes mortality and growth reduction in infected trees: A decrease in the quantity, quality, and germination percentage of seeds produced; and lowers timber quality. Severely infected trees are more susceptible to attacks by insects and other diseases and to environmental stresses such as drought. Heavily infected trees (DMR = 5 or 6) may sustain a 20 to 50 percent reduction in growth when compared to uninfected trees and their life expectancy is severely decreased (Lightle and Hawksworth, 1973). Dwarf mistletoe infects trees of all ages and is thus a problem in second growth and regeneration, as well as mature and overmature stands.

Spread of southwestern dwarf mistletoe is a function of stand density, age, and site index, and averages one to two feet a year. Spread is most efficient and rapid from an infected overstory to an understory and slowest through an even-aged stand. Management of southwestern dwarf mistletoe is directed toward decreasing spread and intensification of disease since SWDM eradication is achieved only by removing the entire stand of trees.

The following suggestions for SWDM control in recreational forests are offered based on a 20 year study conducted by Lightle and Hawksworth (1973) in Grand

Canyon National Park:

-Pruning is recommended in lightly infected trees (DMR <3). Remove branches two whorls above highest SWDM-infected branch to insure against latent infections. No more than 50% of the live crown should be removed.

-Confine pruning to more isolated trees. Repruning has been required in densely stocked stands due to numerous latent infections in areas initially considered lightly infected.

-Infected branches should be cut off at the bole in order to insure removal of the endophytic, root-like system in the host tissue.

-Trees with bole infections do not need to be killed since bole infections are not vigorous.

-Pruning witches brooms on heavily infected trees (DMR = 3-4) does prolong life. A shorter life expectancy corresponds to higher DMR.

Other management strategies include:

-Sanitize densely stocked stands. The most severely infected trees are removed to eliminate much of the inoculum and promote vigor of lightly and noninfected trees.

-Remove severely infected overstory trees. A vegetation management plan is desirable, with emphasis on nonhost species eventually replacing dwarf mistletoe-infected trees.

-Apply ethylene-releasing chemicals to promote abscission of dwarf mistletoe aerial shoots (Beatty, et.al., 1988; Nicholls, et.al., 1987). This method greatly reduces seed dispersal; the pathogen is not eliminated since the endophytic system remains viable within the host tissue and new aerial shoots form in two to five years. Chemicals need to be reapplied every few years, making this method suitable to high value areas where susceptible trees have been planted under an infected overstory.

Western Pine Beetle - *Dendroctonus brevicomis*:

Western pine beetles mass-attack stands of ponderosa pine, carrying and transmitting fungi which aid in killing the host. Western pine beetles produce between two and four generations per year depending on latitude and elevation. Flight and attacks start in late spring or early summer and continue until the onset of cold weather (DeMars, 1982). Western pine beetle attacks are initiated by adult females, usually at mid bole. Evidence of attack is marked by white to reddish pitch tubes on the bark. The attack process is mediated by chemical messengers or pheromones released by the beetles in combination with host terpenes. The beetles excavate winding sinuous egg galleries under the bark which often cross. Eggs are laid in niches chewed into the sides of the gallery. Once the eggs hatch the larvae feed in short galleries perpendicular to the parent gallery. Later larval stages feed in the middle bark. Pupation also occurs there. Brood adults first feed in the middle and outer bark before emerging. This cycle varies in length from two to ten months depending on temperature.

This insect usually breeds in scattered, slow growing overmature trees and diseased or damaged trees. Group killing is also common in dense, overstocked stands of young sawtimber. Trees under six inches in diameter are seldom attacked. Environmental stresses which permanently weaken individual or small groups of trees (root diseases, mistletoes, mechanical damage) or temporarily weaken whole stands (droughts, defoliators, fires) predispose trees to attack and create conditions for outbreaks to occur. A good example was documented in southern California where effects of ozone damage were examined. There it was found that beetle productivity was greater in ozone damaged trees since fewer attacks were required to kill the tree. The ratio of brood emergence to attacking beetles was greater for the ozone affected trees.

There are a number of natural enemies of this insect including woodpeckers, and several parasitic and predatory insects. However, the main factor thought to influence occurrence of outbreaks is the abundance of suitable hosts. Suppression of western pine beetle populations has often been found to be expensive and unsatisfactory since timely spotting and treatment is difficult. However, sanitation-salvage logging can be applied to minimize losses. Prevention of outbreaks is the most effective way of reducing losses. Unacceptable losses can be prevented in most circumstances (barring severe drought) by maintaining thrifty, vigorous trees. Thinning dense 70-80 year old sawtimber stands, thereby reducing stocking to 55-70 percent of the basal area necessary for full site utilization, relieves competitive stress among remaining trees, making them less prone to successful attack.

Individual high value trees that are predisposed to attack by temporary injury may be given a protective residual bark spray to prevent successful attack. Such treatment can be effective if the protection for one or two years would allow the tree to recover. It should not be considered for trees suffering from severe root disease or damage.

Pine Engraver Beetles - *Ips* spp.

Several species of pine engraver beetles attack downed and standing ponderosa pine in the Southwest, including Arizona five-spined engraver, *I. lecontei*; the pine engraver, *I. pini*; the six-spined engraver, *I. calligraphus*; *I. knausi*, and *I. integer*. The beetles usually produce two to four generations per year depending on climate and elevation (Parker, 1979; Sartwell, et. al. 1971). Flight and attacks usually begin in April or May, whenever daily maximum temperatures reach 60-70 degrees F. (Livingston, 1979) and continue until the onset of cold weather. Engraver beetle attacks are initiated by adult males. Evidence of attack is marked by reddish-brown boring dust in bark crevices and at the tree base on standing trees. Occasionally small pitch tubes are formed. The attack process is mediated by pheromones released by the beetles in combination with host terpenes. The male is joined by one to many females. After mating each female constructs an egg gallery in the inner bark, slightly scoring the wood surface in the process. Very often the galleries will form an inverted Y pattern oriented parallel to the grain of the wood (Sartwell et. al., 1971). Egg galleries are usually free of boring dust. This feature readily distinguishes them from the *Dendroctonus* spp. Eggs are laid on each side of the gallery. Larvae feed in mines that run laterally from the egg gallery. These larval mines are packed with frass. Pupation occurs in an oval cell chewed by the larva. Brood adults may congregate and feed under bark before emerging (Sartwell et. al., 1971). In the Southwest this cycle varies

in length from about one month in mid summer to eighty days at other times (Parker, 1979).

These insects prefer to attack freshly cut slash, windthrow and snow broken material, particularly the spring attacking generation (Livingston, 1979). Standing green trees may also be attacked, many times only the tops are killed on larger trees. A number of factors may increase pine engraver activity:

-Presence of green slash in spring (January-June) (Livingston, 1979, Parker, 1979),

-spring drought (<75 percent normal precipitation) (Livingston, 1979),

-stagnating stand conditions (Livingston, 1979),

-diseases such as dwarf mistletoe (Parker, 1979).

The most damaging outbreaks occur when fresh slash or weakened trees are present in the same area for two or more consecutive years (Parker, 1979).

A number of natural factors help hold populations in check, however, preventative measures are most effective in reducing losses. A number of preventative tactics are described in the Cutting Methods Handbook (2409.26a, Chapter 62).

-Maintain or improve stand vigor through precommercial and commercial thinning.

-Monitor green slash and standing trees for evidence of infestation, particularly during April-July in drought years.

-Where the threat of *Ips* is a concern, slash creating activities should be conducted from July-December.

-Minimize creation of slash during the months of January-June. When it is impractical to do this, slash should be chipped, burned, or crushed. In some cases, a lop and scatter treatment to promote drying is sufficient.

-Avoid management activities that create slash or weakened trees for two or more consecutive years in the same area.

Determining whether or not attempt to suppress an existing *Ips* population in slash is difficult. Suppression may not be successful if infestations are not detected early enough. Further there is no reliable method to determine if populations in slash will attack nearby standing trees. For more information on recommended suppression methods please refer to the Cutting Methods Handbook (2409.26a, Chapter 62).

MANAGEMENT ALTERNATIVES

The following alternatives are offered for your consideration. Positive and negative aspects of some of the alternatives are discussed. The discussion of alternative 1 indicates the effects of doing nothing. Alternatives 2 and 3

focus on management of hazard trees. A variety of treatments are suggested in 4 and 5.

1. Do nothing. Trees rated as potential hazards will continue to decline and the probability of failure will increase. Trees will continue to be damaged by campers and by natural causes, so the number of potential hazards will also increase. The possibility of tree failure with property damage and injury to people will increase. Dwarf mistletoe-infected trees will continue to decline in health and vigor and serve as inoculum for spread and intensification of disease. Risk of mortality will continue and likely increase on densely stocked sites as well as those with dwarf mistletoe, due to greater susceptibility to attack by bark beetles.

2. Remove or lessen the probability of failure of hazard trees. This alternative would involve removing trees that have been identified as potential hazard trees. The manager decides on the level of acceptable risk at the site. As described earlier, there are two components to a hazard rating, probability of failure and that of injury or damage. Not all trees rated with a high risk of failure need be treated or removed, unless they also pose a significant risk of injury or damage. In many cases, pruning dead branches and large brooms can substantially reduce the probability of failure. Dead tops on conifers should be removed as soon as practical (Mills and Russell, 1981). Dead and potentially hazardous branches were noted on a number of oaks, both Gambel and Emory, at all three campgrounds. For trees with internal defects, the thickness of sound wood in the outer shell determines structural soundness (Johnson, 1981). Other defects can increase the risk of failure for trees with internal rot. For example, a leaning tree can tolerate less rot than an upright tree. No evidence of trunk decay was detected at this time at any of the sites. The most common cause of failure for both softwoods and hardwoods is root injury, particularly that from root diseases. Fortunately, no evidence of root disease was noted. A number of recently killed pines were recorded at Mingus Mountain CG. It was determined that these are structurally sound at this time, however, over time natural decay processes will increase the likelihood of failure. These trees should either be removed or monitored closely if they are located in areas of intensive use.

3. Remove the targets. Under this alternative, campgrounds or selected areas within campgrounds that are identified as targets are closed to public use. Removal of potential targets will remove the problem of hazard trees. This alternative is probably best suited for situations where large numbers of hazard trees are present and where removal may be impractical for various reasons. For example, in campgrounds with extensive root disease, it is sometimes better to move the campground and then attempt to rehabilitate the site. We do not believe that this rather extreme measure is warranted in any of the three campgrounds we surveyed for this evaluation. At other times, particular camp pads or other structures can be moved within the campground. This might be a possibility for severely dwarf mistletoe infected portions of Mingus Mountain CG.

4. Develop a vegetation management plan. A vegetation management plan identifies specific goals and objectives for the campground. Often different stands may be identified within the area, each with its own vegetation objective. These objectives may include the reduction of pest activity and hazard tree development. It may recommend activities such as: Thinning a

dense stand of trees to reduce stress and the probability of bark beetle attack; sanitizing to decrease the incidence of dwarf mistletoe infection; pruning dwarf mistletoe infected trees to prolong life and reduce likelihood of branch failure; and planting nonhost species under an infected ponderosa pine overstory. This would be a good alternative for the Mingus Mountain CG if a plan has not been developed previously. Several of the activities mentioned above may be appropriate for Mingus Mountain CG. Thinning portions of the campground would reduce the future hazard of tree mortality caused by beetles. In the area denoted DM 1 on the map of the campground (Appendix B), a couple options could be considered. Since the trees in that area will be declining some sort of rehabilitation may be needed. We would recommend a thinning to sanitize the area further followed by planting either with nonhost species, or if necessary, ponderosa pine. If pine is planted, the overstory should either be removed entirely or treated with ethephon at intervals to eliminate dwarf mistletoe seed production. In the area denoted DM 2, the same comments apply. In addition, a portion of this area has already been opened up due to mortality of heavily infected trees not removed in the previous treatment. Mortality will continue in this area, further opening up the site. Planting should also be considered for this area.

5. A combination of alternatives 2, 3, and 4. These alternatives are not mutually exclusive and can be used in combination to solve specific problems in many areas.

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APPENDIX A

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit Verde RD

Examined by Todd R & S 1 of 3

Site name Mingus MTN CG

Date 7-31-89

	Campground or Picnic Unit No.	Tree location (azimuth and distance from fixed object)[1] Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.I.B.	*See abbreviations Type of defect				Potential targets			Failure rating[2]			Risk rating[3]			Additional comments *Defect abbreviations: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak fork C=Conk(s) DT=Dead top ER=Exposed roots	Action
					Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	High	Medium	Low	High	Medium	Low		
1	4	TB, 344° 27'	PP	5.7					X				X		X			Dead tree western pine beetle &	IPS
2	4	TB 344° 41'	PP	4.5						X			X			X		" " "	
3	4	TB 355° 51'	PP	7.1					X					X	X			" " "	
4	7	TB 320° 10'	PP	9.6					X				X		X			Dead tree "	
5	7	TB 334° 30'	PP	8.5				X	X					X	X			Dead top	
6	7	TB 360° 9'	PP	4.3					X				X		X			Dead tree, Western pine beetles	
7	7	TB 32° 46'	PP	7.2						X			X			X		" "	Broken top
8	14	TB 144° 46'	PP	5.0				X	X					X	X			Dead tree - mistletoe	
9	15	TB, 218° 3'	PP	7.0					X					X	X			Broken top	

1 Sketch map on reverse side.
2 Probability of a tree failing within the next 5 years.
3 Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit Verde R.D. Examined by Todd R&S 2 of 3

Site name Mingus Mt. C.G. Date 7-31-89

Campground or Picnic Unit No.	Tree location (azimuth and distance from fixed object)[1] Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure rating[2]: High	Medium	Low	Risk rating[3]: High	Medium	Low	Additional comments *Defect abbreviations: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak fork C=Conk(s) DT=Dead top ER=Exposed roots	Action
15	TB 173° 19'	GO	12.3					X			X			X			Dead	
15	TB 42° 24'	PP	8.2					X					X	X			Broken top	
15	TB 331° 30'	PP	5.5					X				X		X			Dead	
14	TB 95° 79'	PP	9.6						X				X		X		Dying (Bark Beetle attack)	WPB
16	TB 231° 15'	GO	9.4				X	X			X			X			DTop	
16	TB 263° 16'	GO	9.4				X	X			X			X			DTop	
18	TB 121° 22'	GO	16.0				X	X				X		X			DTop	
19	TB 92° 117'	PP	7.0						X			X			X		Dead WPB	
19	TB 92° 113'	PP	11.3						X			X			X		Dead WPB	

1 Sketch map on reverse side.
2 Probability of a tree failing within the next 5 years.
3 Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit Verde RD

Examined by TODD R&S 3 of 3

Site name Mingus Mt. CG

Date 7-31-89

Campground or Picnic Unit No.	Tree location (azimuth and distance from fixed object)[1] Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure rating[2]: High	Medium	Low	Risk rating[3]: High	Medium	Low	Additional comments *Defect abbreviations: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak fork C=Conk(s) DT=Dead top ER=Exposed roots	Actio
19	TB 92° 110'	PP	13.0						X			X			X		Dead WPB	
25	TB 202° 10'	PP	5.5					X					X	X			Dead WPB, broken top	
25	TB 237° 38'	PP	9.0						X		X				X		Dead	
25	TB 212° 37'	PP	4.0						X			X			X		Dead	

1 Sketch map on reverse side.
2 Probability of a tree failing within the next 5 years.
3 Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit VERDE R.D. Examined by TODD

Site name Potato PATCH Date 8-1-89

Campground or Picnic Unit No.	Tree location (azimuth and distance from fixed object)[1] Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.B.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure rating[2]: High	Medium	Low	Risk rating[3]: High	Medium	Low	Additional comments *Defect abbreviations: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak fork C=Conk(s) DT=Dead top ER=Exposed roots	Action
NO	37' 300° FR	PP	11			X		X					X	X			Bole Wound (Last picnic site)	
#'s	120' 28° TB	BO	17			X			X				X		X		4th table on leftside of loop	
see add. comment																	as you come in.	
section	22° 63' TO	PP	19				X		X			X			X		Dead top - Location from 1st outhous	
	300° 86' FR	PP	35				X					X			X		Dead fork → Western Pine beetle.	
																	1st rt. on Right side of road	

1 Sketch map on reverse side.
2 Probability of a tree failing within the next 5 years.
3 Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit Verde R.D

Examined by Todd S&R

Site name Powell Springs CG

Date 8-3-89

Campground or Picnic Unit No.	Tree location (azimuth and distance from fixed object)[1] Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure rating[2]: High	Medium	Low	Risk rating[3]: High	Medium	Low	Additional comments *Defect abbreviations: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak fork C=Conk(s) DT=Dead top ER=Exposed roots	Act
8	TB 130° 2'	EO	15.0				X	X				X		X			Weak fork	
7	FR 28° 22'	EO	12.5				X	X			X			X			Dead top	
~~TO~~#1	TO 6° 30'	EO	15.0				X		X		X				X		Weak fork	
2	TB 73° 29'	EO	17.0				X	X				X		X			Dead Top	
2	TB 300° 34'	EO	12.5				X	X				X		X			Dead Top	
1	TB 360° 34'	EO	17.0				X	X			X			X			Dead Top	
3	TB 132° 3'	EO	19.5				X	X			X			X			Weak Fork	

1 Sketch map on reverse side.

2 Probability of a tree failing within the next 5 years.

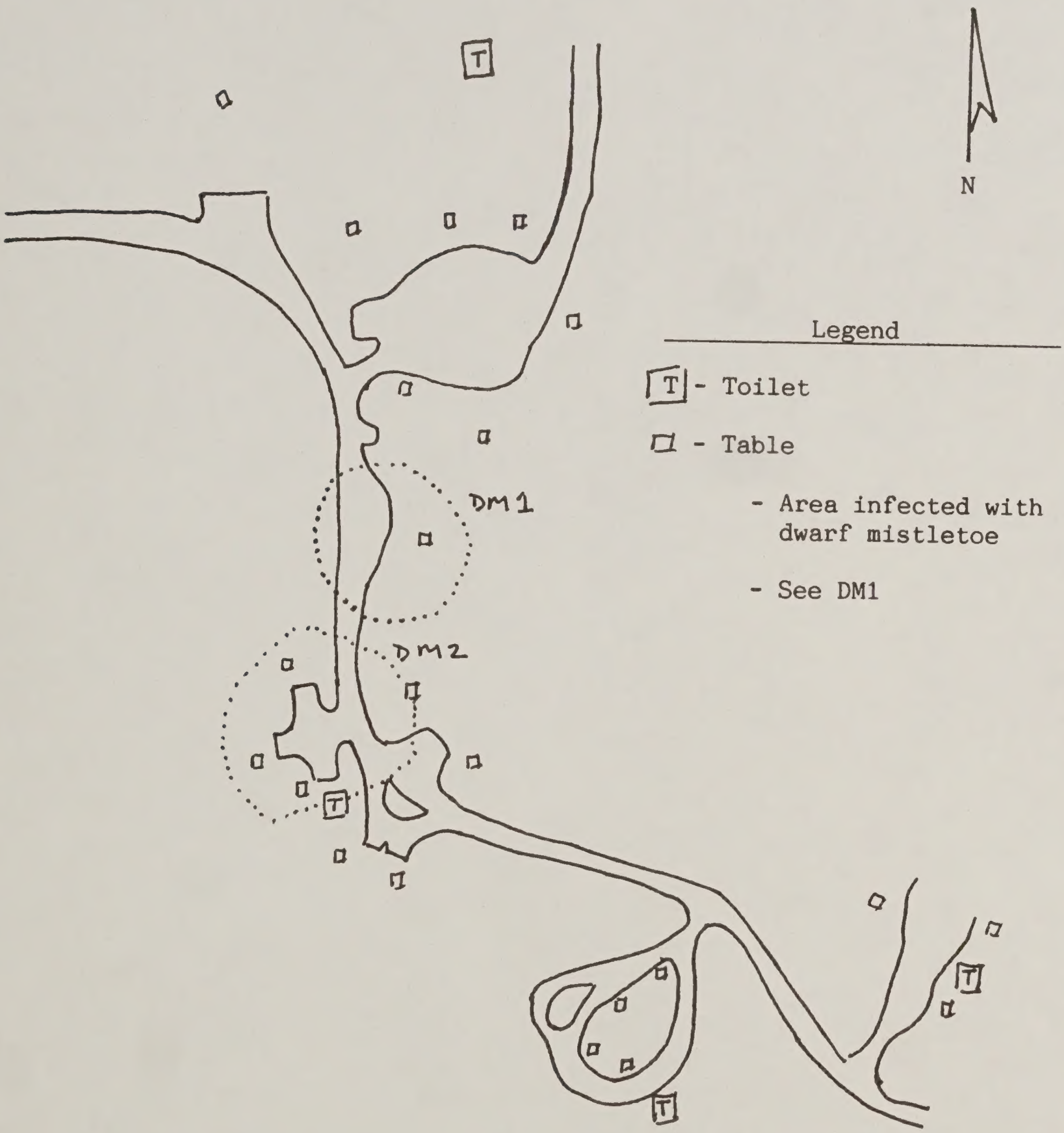
3 Probability of a tree hitting a potential target.

EO = Emory Oak

APPENDIX B

FIGURE 1

Map of Mingus Mountain Campground
Camp Verde Ranger District, Prescott National Forest



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